

Health Consultation

Burlington Environmental Incorporated Georgetown
Seattle, King County, Washington

August 2, 2002

Prepared by

**The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of a health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond quickly to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

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Glossary

Acute	Occurring over a short period of time. An acute exposure is one which lasts for less than 2 weeks.
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Chronic	A long period of time. A chronic exposure is one which lasts for a year or longer.
Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.

Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short-term (acute) or long-term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Indeterminate public health hazard	Sites for which no conclusions about public health hazard can be made because data are lacking.
Inorganic	Compounds composed of mineral materials, including elemental salts and metals such as iron, aluminum, mercury, and zinc.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.

Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
Monitoring wells	Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant.
No apparent public health hazard	Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.
No public health hazard	Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water.

Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Plume	An area of contaminants in a specific media such as groundwater.
Route of exposure	The way in which a person may contact a chemical substance that includes ingestion, skin contact and breathing.
U.S. Environmental Protection Agency (EPA)	Established in 1970 to bring together parts of various government agencies involved with the control of pollution.
Volatile organic compound (VOC)	An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

The Washington State Department of Health (DOH) has prepared this health consultation report in response to a request from the Washington State Department of Ecology (Ecology) to review and comment on the Philip Services Corporation (Philip Services), *Draft Inhalation Interim Pathway Interim Measures Work Plan*, dated May 31, 2002. DOH conducts health consultations under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

The Philip Services' Georgetown facility is a treatment and temporary storage facility for industrial and household hazardous waste. The facility receives, treats, packages, and ships the hazardous waste for off-site treatment and/or disposal. Leaking underground storage tanks and other releases that occurred at the facility in the past appear to be the source of contaminants detected in groundwater below the Philip Services property as well as below the mixed residential, commercial, and industrial properties located to the west and southwest of the facility. The contaminants include petroleum and volatile organic compounds (VOCs), such as trichloroethylene, vinyl chloride, and benzene.

DOH, the Environmental Protection Agency (EPA), and Philip Services conducted indoor air sampling in August 2000 to determine whether buildings located over the most contaminated portion of the groundwater plume contained chemicals at levels of health concern. To supplement previous sampling data, DOH conducted additional indoor air sampling in March 2001. A number of chemicals were found in indoor air at the tested buildings during both indoor air sampling events. However, many of the chemicals are associated with common household products and outdoor air sources such as automobile exhaust. None of the chemicals found in the buildings were at levels of immediate health concern.

Discussion

The proposed inhalation pathway interim measures work plan (work plan) provides a method for continuing to monitor whether residents and workers located above the groundwater contaminant plume are being exposed to chemicals in indoor air at levels of health concern. The plan also provides measures that can be taken if chemicals are detected at levels of health concern.¹

DOH identified a number of concerns about the work plan during its review: (1) some of the information about the soil gas exposure pathway is inaccurate; (2) some of the site investigation summaries, which are intended to provide background information to support the proposed interim measures, are incomplete; (3) insufficient information is available to evaluate the proposed procedures for evaluating the inhalation pathway; (4) a common radon mitigation method that could be used to prevent groundwater contaminants from migrating into indoor air at buildings with crawl spaces was not included in the plan; and (5) some of the proposed sampling and analytical procedures could result in an underestimation of the risks posed by the site. Specific comments on the draft work plan, and recommendations are as follows:

Soil Gas Exposure Pathway

1. **Section 2.1, Migration of Soil Gas from Groundwater to Indoor Air** – The work plan indicates that the way in which an individual can become exposed to contaminated soil gas is by living or working in a building located above the VOC contaminated groundwater. However, this is not the only way an individual can be exposed to soil gas at the site. Someone living or working near, but not over, the groundwater plume may also be affected because VOCs can migrate through the vadose zone or through utility backfills. Someone excavating soils over or near the groundwater plume may also be exposed to VOCs in soil gas.

Recommendation – The revised work plan should note the various ways an individual can be exposed to contaminated soil gas.

Site Investigation Summaries

1. **Section 2.2.1, Source Area Investigation East of Denver Avenue (Area 2)** - Information provided in the work plan suggests that the source area dense non-aqueous phase liquid (DNAPL) investigation focused on the saturated zone. However, DNAPLs could also be present in the vadose zone, which could be another potentially significant source of chemicals that could migrate into nearby homes and businesses.

Recommendation - Information about the boundaries of DNAPLs in the vadose zone should also be provided in the work plan.

2. **Section 2.2.4, Concurrent Soil Gas, Indoor Air, and Groundwater Sampling Events-** The work plan notes that the empirical data collected during the concurrent sampling events conducted by DOH, EPA, and Philip Services in August 2000 and March 2001 are summarized in work plan Table 2-1. However, less than half of the chemicals analyzed by DOH during the two sampling rounds are included in the table. In addition, the EPA Method TO-15 analytical results obtained by DOH during the March 2001 sampling were incorrectly reported in the table. The March 2001 samples were run using the standard TO-15 scan mode and selected ion mode (SIM). Chemicals with concentrations that were less than 2.0 ppbv were further analyzed using SIM mode. The linear range for the SIM analysis was approximately 0.05 ppbv to 2.0 ppbv.

Recommendation - The text should be revised to accurately reflect the content of work plan Table 2-1. The table should be revised to present accurate results.

Elements for Developing Inhalation Pathway Interim Measure Action Levels

1. **Section 3, Procedures for Evaluating the Inhalation Pathway and the Need for Interim Measures-** A great deal of uncertainty is associated with the procedures described in the work plan for evaluating the inhalation pathway since they rely on estimated soil properties, short-term ambient air sampling results, literature values for

background indoor and outdoor air, and extrapolation from target compounds to non-target compounds.

Recommendations - The Johnson & Ettinger model should be used to help determine whether the proposed approach for predicting indoor air concentrations across the groundwater contaminant plume is accurate. Additional indoor air sampling, or a combination of modeling and indoor air sampling, should be periodically conducted to ensure that the proposed approach continues to be an effective means of predicting indoor air concentrations in buildings located above the contaminated groundwater plume.

2. **Section 3.1.1, Identification of Target Compound for Development of GIVFs** - The work plan recommends that trichloroethylene (TCE) and benzene, ethylbenzene, toluene, and xylene (BETX) compounds, significant contaminants of concern for the inhalation pathway at this site, be excluded as target compounds because they are commonly found in urban indoor air. However, it is unclear why this approach was proposed when some of Philip Services' proposed target compounds are also associated with products commonly used in an urban environment. For example, 1,1,1-trichloroethane is used as a dry cleaning agent, propellant, and solvent; 1,2 dichloroethane is used as a gasoline additive, dry cleaning agent and ingredient of insecticides; and chloroethane is used as a solvent and refrigerant.^{2, 3}

Elevated levels of petroleum have been detected in shallow groundwater at the Philip Services' facility as well as down-gradient of the facility along Denver Avenue South. However, petroleum and its associated compounds have not been included as target compounds.

Recommendations - TCE and the BETX compounds should be retained as target compounds. In addition, petroleum hydrocarbons (fractionated ranges as well as individual petroleum compounds) should be considered as target compounds at buildings where petroleum plumes underlie or are located close to homes and businesses. The Massachusetts Department of Environmental Protection has a draft method for determining levels of air phase petroleum hydrocarbon concentrations that may be useful or determining whether petroleum plumes may be affecting indoor air quality at the Philip Services' site.⁴

3. **Section 3.1.2, Selection of Sample Locations for Development of GIVFs** - Five buildings with basements, three with crawl spaces, and one building with slab-on-grade construction within a two block area immediately west of Denver Avenue S. are proposed to be sampled during the groundwater to indoor air volatilization factor (GIVF) study. A number of questions need to be answered when evaluating whether the proposed sampling locations are appropriate for the development of GIVFs: (1) is the area proposed to be sampled representative of the vadose zone across all of Area 3, does it represent worst case vadose zone conditions within Area 3 (i.e., most permeable soil

conditions), or some other scenario? (2) do the buildings proposed for sampling represent a range of conditions for the entire area above the groundwater contaminant plume, including worst case conditions, or some other scenario?; and (3) are the number of buildings proposed for each foundation type sufficient for determining GIVFs across the site? The information necessary to answer these questions is not provided in the work plan.

Recommendation - The revised work plan should provide adequate supporting information such as maps and/or cross sections demonstrating that the geology of the vadose zone in the study area is representative of the entire site, or represents a worst case scenario (i.e., vadose zone containing high permeability, clean sands). The revised plan should also include a discussion about the representativeness of the buildings selected for the study. At least one additional building with a slab-on-grade construction should be included in the GIVF study. Supporting information should be provided in the work plan to justify the number of proposed locations for each building type (basement, crawl space, and slab-on-grade) for a statistical evaluation.

4. **Section 3.1.2, Selection of Sample Locations for Development of GIVFs** - No alternate sampling locations have been included in the work plan in the event that one or more of the property owners/tenants are unwilling to participate in the sampling program.

Recommendation - A list of alternate sampling locations should be developed and included in the work plan, along with the rationale for the alternate locations.

5. **Section 3.1.2, Selection of Sample Locations for Development of GIVFs, Request for Access Letter (Appendix C)** - Philip Services' proposed access letter indicates that the recipient should contact Philip Services if they are willing to have their property included in the indoor air, soil gas, and groundwater sampling. It should be Philip Services' responsibility to follow up with the property owner/tenant.

Recommendation - Philip Services should revise the letter to indicate that they will contact the recipient within a week to ask whether homeowners/tenants are willing to participate in the sampling. This will give the property owner/tenant sufficient time to consider the request, but within the time constraints of the investigation.

6. **Section 3.1.3, Development of GIVFs, Subsection 3** - The work plan indicates that indoor air sampling results will be adjusted for background contributions using the maximum ambient air or literature values. However, there is no reason to believe that maximum ambient air concentrations or maximum literature values are representative of Area 3.

Recommendation - Philip Services should use median ambient air concentrations and median literature values for ambient and indoor air from studies that the agencies

determine are appropriate.

7. **Section 3.1.3, Development of GIVFs, Subsection 7** - Site specific parameters are proposed to be used in the Johnson & Ettinger model to predict indoor concentrations of target and non-target compounds, which will be used to derive an adjustment factor. However, it is not clear that the soil property values are appropriate for the study area.

Recommendation - Logging and geotechnical testing of the vadose zone in the study area should be conducted. The results should be compared to the proposed modeling values presented in work plan Table 3-3 and the table should be revised, as appropriate. A range of values should be used in the model, if warranted.

8. **Section 3.1.4, Development of Inhalation Pathway Interim Measure Action Levels for Indoor Air and Groundwater** - DOH cannot determine whether the proposed inhalation pathway interim action levels (IPIMALs) for indoor air and groundwater are appropriate. IPIMALs for groundwater were calculated using IPIMALs for indoor air and the GIVFs. Indoor air IPIMALs were reportedly based on preliminary remedial action levels (PRALs). However, no information is provided about the relationship between the PRALs and IPIMALs. In addition, it is not clear why PRALs, which appear to be based on modeling results, were used when Model Toxics Control Act (MTCA) cleanup levels are available.

Based on a spot check of the indoor air IPIMALs presented in work plan Table 3-4, it appears that many exceed MTCA cleanup values by a factor of about 1,000. However, it is not clear whether the IPIMAL units were incorrectly reported, or if they were designed to exceed the cleanup levels by a factor of 1,000.

Recommendation - Basic information such as the assumptions and equations used to derive the IPIMALs should be included in the revised work plan. An explanation about why modeled values were used to develop the indoor air IPIMALs rather than MTCA cleanup levels should also be provided.

9. **Section 3.3.2, Determination of Impacts to Commercial Buildings** - Commercial based IPIMALs were reportedly developed using commercial intake assumptions. However, the assumptions and equations used to derive the IPIMALs were not provided.

Recommendation - The commercial intake equations and assumptions should be summarized in the final work plan.

Interim Technologies

1. **Section 4, Review of Methodologies-** Perforated pipe installed in a gravel bed that is

sealed with a Visqueen cover and vented through a piping system containing a fan is another type of radon mitigation system that has been effectively used in homes with a crawl space. However, this type of system was not included in the work plan.

Recommendation - The radon mitigation measure for a building with a crawl space, described above, should be considered as a possible interim measure and included in the work plan. A qualified radon contractor should be consulted to ensure that the system is designed appropriately.

Sampling and Analysis Plan

1. **Section 3.2, Preparation of Buildings for Sampling, Figure 3, Building Evaluation Form** - Three categories of building occupants are included in the building evaluation form: adult, children under 13, and children 13-18. It is not clear why these categories were selected since they are not commonly used in risk assessments.

Recommendations - The building evaluation form should be revised to include the following categories of building occupants: children under 6, children 6-15 years, and adults.

2. **Section 3.8, Indoor Air Sampling Methodology; Section 4.6, Ambient Air Sampling; and Section 5.6, Soil Gas Sampling Methodology** - EPA Method TO-14A is the proposed analytical method for the indoor air, ambient air, and soil gas samples. However, based on information provided in the EPA Method TO-15, it appears that TO-14A method may not be the optimal choice. For example, it appears that the TO-14A method can alter the structure of the VOCs or reduce the sample stream concentration.⁵

Although significant petroleum contamination has been found at the Philip Services and adjacent properties along Denver Avenue South, no petroleum analysis is proposed.⁶

Recommendation - Indoor air, ambient air, and soil gas samples should be analyzed using EPA Method TO-15. In addition, petroleum hydrocarbon analyses should also be conducted. As noted above, the state of Massachusetts has draft analytical guidance for evaluating petroleum hydrocarbons in air.

3. **Section 4.2, Sampling Location** - A minimum of one ambient air sample is proposed to be collected at least 2 feet from the ground surface to ensure that soil gas does not enter the sampling canisters. However, it is unclear whether 2 feet is adequate to prevent soil gas interference. In addition, one outdoor air sample is not adequate for determining ambient air concentrations for the proposed study since localized activities such as an idling car can influence the sample.

Recommendation - A minimum of three ambient air samples should be collected at least 6 feet above the ground surface to reduce the uncertainty about the results and to reduce

the chance of soil gas interference.

4. **Section 5.3, Soil Gas Sampling Methodology** - Prior to sampling, each soil gas probe is proposed to be purged for 3 minutes at 300 milliliters/minute. The rationale for this approach is reportedly presented in Philip Services 2001, Soil Gas Sampling and Analysis Plan, a document that DOH was not provided.

Recommendation - The purge rationale should be provided in the revised work plan.

5. **Section 6.3, Direct Push Groundwater Sampling Methodology** - Groundwater samples are proposed to be collected from the bottom of the tubing used with a peristaltic pump. If samples cannot be collected in this manner, then the sample will be collected through the pump.

Recommendation - Since VOCs can be lost when collecting a groundwater sample with a peristaltic pump, a statement should be added to the sampling and analysis plan indicating that sampling personnel must record on the sampling form whether the sample was collected from the bottom of the tubing or through the pump. The field sampling forms and the sampling results should be submitted to the agencies.

6. **Section 6.6, Direct Push Groundwater Sample Analysis** - Significant levels of petroleum have been identified in shallow wells on Philip Services property, Amalgamated Sugar's property, and along Denver Avenue South. However, no petroleum analyses are proposed for groundwater.

Recommendation - Petroleum hydrocarbon analysis should be conducted for groundwater.

7. **Section 7, Geotechnical Soil Testing** - The sampling and analysis plan indicates that the geotechnical soil testing *may* be conducted after the indoor air samples are collected although it appears that only limited information currently exists for the vadose zone.

Recommendation - Vadose zone soil samples should be collected for geotechnical testing at a number of locations within the study area. These results can be used to confirm the parameters proposed in the work plan for estimating adjustment factors (Work Plan, Table 3-3.) In addition, typical geotechnical logging should be completed for each boring, including soil descriptions and classifications, soil density, moisture content, and other relevant subsurface information. These tasks should be included in the revised sampling and analysis plan.

Child Health Initiative

The groundwater contaminant plumes associated with the Philip Services' Georgetown facility are located in a mixed industrial, commercial, and residential area where children potentially could be exposed to groundwater contaminants through the indoor air pathway. Children can be uniquely vulnerable to the hazardous effects of environmental contaminants. When compared to adults, pound for pound of body weight, they breathe more air. This fact may result in increased exposures to contaminants from various environmental media. Additionally, the fetus is highly sensitive to many chemicals, particularly ones that have been shown to cause developmental effects. For these reasons, it is very important to consider the specific impacts that contaminants may have on children, as well as other sensitive populations.

Conclusions

1. The draft inhalation pathway interim measures work plan was developed to continue to evaluate whether occupants of buildings located above the contaminated groundwater plume associated with the Philip Services' facility are being exposed to harmful levels of chemicals through the indoor air pathway. The proposed work plan, however, has some deficiencies that will prevent DOH from continuing to evaluate the groundwater to indoor air pathway. As a result, the site would be categorized as an indeterminate health risk.

Recommendations/Action Plan

1. Philip Services should revise the draft inhalation pathway interim measures work plan based on DOH's recommendations.
2. Philip Services should provide subsequent project plans and reports to DOH for review.
3. DOH will continue to be available to assist Ecology with indoor air issues at the site.

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References

1. Philip Services Corporation, Draft Interim Pathway Interim Measures Work Plan, May 31, 2002.
2. Washington State Department of Ecology, Chemicals of Special Concern in Washington State, July 1992.
3. Agency for Toxic Substances and Disease Registry, Toxicological Profile for Chloroethane, December 1998.
4. Massachusetts Department of Environmental Protection, Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH), Public Comment Draft 1.0, February 2000.
5. Environmental Protection Agency, Compendium Method TO-15, January 1999.
6. Philip Services Corporation, Quarterly Report January - March, 2002, June 15, 2002.

Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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